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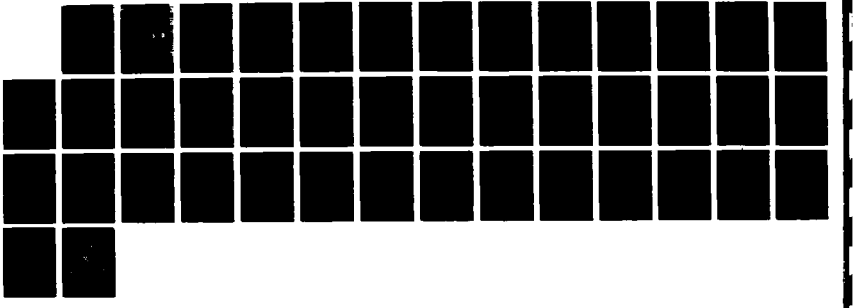

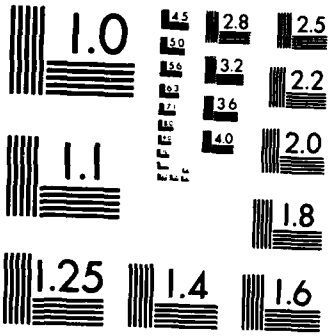

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Potential Data Exchange Between Various Army Systems Using the Data Traffic Management System

by
Patrick Tanner

As part of the development of the Data Traffic Management System (DTMS), this report discusses potential interfaces between various existing and planned Army information management systems and data bases. Data elements which can be shared between various systems and databases are described. When such data exchange is inappropriate, this is reported. These potential interfaces were investigated by examining the systems' documentation materials and (in some cases) by interviewing people responsible for systems still being developed. Numerous possibilities for data exchange via DTMS were discovered.

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As part of the development of the Data Traffic Management System (DTMS), this report discusses potential interfaces between various existing and planned Army information management systems and data bases. Data elements which can be shared between various systems and databases are described. When such data exchange is inappropriate, this is reported. These potential interfaces were investigated by examining the systems' documentation materials and (in some cases) by interviewing people responsible for systems still being developed. Numerous possibilities for data exchange via DTMS were discovered.

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FOREWORD

This report was compiled by the Facility Engineering Management Team of the Facility Systems (FS) Division of the U.S. Army Construction Engineering Research Laboratory (USA-CERL), under the Technical Director's initiative.

Mr. E. A. Lotz is Chief of USA-CERL-FS. Mr. Patrick Tanner was Principal Investigator for this work. Mr. Michael Fuerst and Mr. Ziyad Shihada contributed to this report. The USA-CERL technical editor was Ms. Jane Andrew, Information Management Office.

COL Norman C. Hintz is Commander and Director of USA-CERL, and Dr. L. R. Shaffer is Technical Director.

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POTENTIAL DATA EXCHANGE BETWEEN VARIOUS ARMY SYSTEMS USING THE DATA TRAFFIC MANAGEMENT SYSTEM

1 INTRODUCTION

Background

A Data Traffic Management System (DTMS)* is being developed to establish data consistency and to coordinate data exchange among the various Army computer software systems used to program, budget, and manage military construction programs. The project is being carried out by the Programming and Execution Support Office of the Directorate of Engineering and Construction, Headquaters, U.S. Army Corps of Engineers (HQUSACE) with the assistance of the U.S. Army Construction Engineering Research Laboratory (USA-CERL).

This effort involves two issues: data consistency and data review. First, data items which should have the same value in more than one software system often do not match when separate organizations or offices maintain the information in each system. Second, one office may have the authority to review and recommend changes to construction project documentation (such as Department of Defense [DD] Form 1391, *Military Construction Project Data*[1]) prepared by another office. The reviewing office should be able to record its suggestions electronically and transmit them via DTMS to the preparing office. That office should then be able to review and accept, modify, or reject this new data.

When data items appear in two systems, and one system's data is updated, DTMS will send a message to the second system showing which items in it also need to be updated. For this procedure to be effective, the interrelationships among systems and databases must be known: which ones use the same information, what exactly is that information, where is it stored, and what are the possibilities for electronically sharing it among the systems?

Purpose

The purpose of this report is to identify the data and textual information which can be shared among certain computer software systems and data support files used in managing military construction programs.

Approach

Documentation (user manuals, data dictionaries, training manuals, Army Regulations) concerning the various systems and data support files was collected and analyzed.

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*A list of acronyms is provided on pp 39-40.

[1] Department of Defense (DD) Form 1391, *FY( ), Military Construction Project Data* (Headquarters, Department of the Army [HQDA], December 1976).

When necessary, telephone conversations with responsible personnel provided additional or unpublished information, especially for systems still in the development stage.

Scope

This report describes only a portion of the potential interfaces among data systems serving military construction programming. The following systems were investigated: Computer Aided Cost Estimating System (CACES); Computer Aided Engineering and Architectural Design System (CAEADS); Construction Appropriations, Programming, Control, and Execution System (CAPCES); Environmental Technical Information System (ETIS); Economic Analysis Package (ECONPACK); Facility Planning System (FPS); DD Form 1391 Processor; DD Form 1390 Module; Project Development Brochure (PDB); and Stationing Analysis Module (SAM). Support databases discussed are Army Regulation (AR) 415-17, Army Location Codes (ARLOC), Department of the Army [DA] Form 2369, DD Form 1657, and District/Division Codes.

Organization

Chapter 2 discusses potential data exchanges between specific software systems. Chapter 3 discusses several data support files containing information such as tables of abbreviations or cost factors which is used by several software systems. In some cases, the data support files have already been integrated into a software system.

2 POSSIBLE DATA EXCHANGE BETWEEN VARIOUS COMPUTER SYSTEMS

CACES/1391 Processor

The 1391 Processor is an established Army system for automating the preparation, editing, and review of DD Form 1391. AR 415-15, *Military Construction, Army (MCA) Program Development*,[2] details the information to be placed in this form. This system assists users in calculating space allowances and cost estimates. Cost estimates prepared using the 1391 Processor can consist of line items for primary, secondary, and support facilities, all of which appear in block 9 of the 1391 form. Cost estimates calculated by the 1391 Processor are budget estimates based on the size of a facility or the size of the population to be served. The 1391 Processor also allows the user to enter (in block 9) cost estimates calculated outside the 1391 Processor. This feature can be used to enter budget estimates but is typically used to replace budget estimates with those based upon partial or complete design information. This "import" feature forms the basis of the CACES/1391 Processor interface. The U.S. Army Engineer Division, Huntsville (CEHND) distributes *DD Form 1391 Processor System User Manual.*[3] Two unpublished documents from CEHND describe the internal data structures of the 1391 Processor: "DD Form 1391 Processor Data File Documentation,"[4] and "SAVE File."*

The 1391 Processor uses two data structures. The first is a data base system utilizing the FOCUS data base management system.** This data base is set up to include:

- Access control, recorded comments, and various submission dates for each 1391 form
- Much of the simple data fields (as opposed to text information) on the 1391
- Data for performing AR 415-17[5] cost estimates
- Category codes from AR 415-28[6]
- Criteria for sizing facilities based on characteristics of the population or area to be served
- Information to effect the retrieval of drawings
- Facility inventories for each installation in accordance with AR 210-20.[7]

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[2] Army Regulation (AR) 415-15, *Military Construction, Army (MCA) Program Development* (HQDA, 1 December 1983).

[3] *DD Form 1391 Processor System User Manual* (U.S. Army Engineer Division, Huntsville [CEHND], April 1986).

[4] "DD Form 1391 Processor System Data File Documentation" (CEHND, May 1984).

*The SAVE file is a document maintained by CEHND on magnetic media, with hard copies available. Its contents change over time, so only its structure is referenced here.

**FOCUS is a trademark of Information Builders, Inc.

[5] AR 415-17, *Cost Estimating for Military Programming* (HQDA, 15 February 1980).

[6] AR 415-28, *Department of Army Facility Classes and Construction Categories* (HQDA, 1 November 1981).

[7] AR 210-20, *Master Planning for Army Installations* (HQDA, 26 January 1976).

The second structure used by the 1391 Processor is a "SAVE" file. There is one file for each 1391 form in the system, and it contains all the information for each form plus a history of the revisions of each field of the form.

CACES is a versatile system which can calculate cost estimates for military construction projects at any stage of the project development, provide standardized formats for these cost estimates, perform in-depth cost analysis through detailed summaries, rapidly execute changes and manipulate data, transmit estimates electronically, and monitor cost changes over time.

CACES consists of various interactive and batch computer programs (in various stages of development) used to produce cost engineering data. The programs are listed below.

- Batch Programs
  - Final Estimate Generator (FEG)
  - Control Estimate Generator (CEG)
  - Mobilization Estimate Generator (MEG)
  - Historical Analysis Generator (HAG)
  - Mechanical Ductwork Area and Weight Calculator (MDAWC)

- Interactive Programs
  - Information Generator (INFOG)
  - CACES Automated Data Entry/Manipulation Software
  - Time Sharing Executive Driver (TEX DRIVER)
  - CACES Electronic Mail Generator (CEMG)
  - Cost Reports Analysis Generator (CRAG)
  - Contractor's Overhead Cost Generator (COCG)
  - CACES Output Report Viewer (CORV)

For additional information on these systems consult the *CACES System Description and Overview.*[8]

The batch programs FEG, CEG, MEG, and HAG, and the interactive program CRAG are the only components in CACES that have potential effects on the CACES/1391 Processor interface. Therefore only these components will be discussed here. Of these five, only FEG and CRAG produce cost estimates which could be sent to the 1391 Processor. CEG, HAG, and MEG create input files which are processed by FEG to generate a cost estimate.

FEG/CRAG/1391 Processor

The FEG requires as input detailed information about the components used to construct a facility. The FEG price data base (known as the Unit Price Book or UPB) provides cost data at a detailed level. The "Create Estimate" program within FEG processes a file containing such detailed information. The "Print Estimate" program of FEG uses the output of "Create Estimate" to produce output reports in any of several formats and levels of detail: project, bid item and facility, Uniform Construction Index (UCI), building system (Uniformat elements), key materials, construction equipment

[8]*Computer Aided Cost Estimating System (CACES) System Description and Overview* (CEHND, April 1985).

(hours of operation), man-hours (by craft), and work categories. Examples of these outputs are contained in Appendix F of Engineer Pamphlet (EP) 415-345-5.[9]

Thirteen different record formats (cards) exist to encode input information for the "Create Estimate" program of FEG. Only some of these are required; the rest are optional. However, two of the optional cards are useful for generating reports to be forwarded to the 1391 Processor: Bid Item (BI) Cards, which divide the project by cost groups; and Facility Cards (FC) which can further divide each bid item into subcost groups. The Project Summary report produced by the "Print Estimate" module of FEG summarizes the project by the divisions specified by the BI and FC cards, and therefore could be used to divide the project into the line items appropriate for transfer via DTMS to block 9 of the 1391 Processor.

CRAG will provide empirical, statistical cost data that is detailed and current for budget cost estimates. CRAG will be accessed directly from the main CACES menu.

The CRAG data base is the same as the AR 415-17 data base, so CRAG could be an alternative source for preparing budget estimates for the 1391 form. Such estimates could be sent to the 1391 Processor just as FEG-generated reports could.

The organization producing a cost estimate at any stage of design does not need to have the authority to change the project's 1391 form. (However, it might be desirable to require that organization to be familiar with the 1391 form.) Any project summary cost estimate that anyone produces using FEG or CRAG could be routed to the 1391 Processor as a DTMS message, thus avoiding delays or interference in the 1391 form review process.

CEMG, which currently provides electronic communication among CACES users, could be used to route Project Summary cost estimate reports to DTMS. (For more details about CEMG, refer to the *CACES System Description and Overview*.

To send a project summary into the DTMS, a CACES user would provide:

- User Information
  - User Title and Name
  - User Installation
  - Current Date

- Form Information
  - Fiscal Year
  - Form Number
  - Installation Name
  - Location of Installation

- Project Information
  - Project Title
  - Category Code
  - Project Number

[9]Engineer Pamphlet (EP) 415-345-5, *Computer Aided Cost Estimating System (CACES) User's Manual* (CEHND, 15 March 1984).

DTMS could then locate the corresponding 1391 form and the organization with change or review authorization for that particular form, and send a message to that organization announcing the availability of an updated project summary from CACES. The next time anyone from the organization accessed the corresponding 1391 form (or possibly whenever they signed on to the 1391 Processor), the individual would either immediately review the new project summary or defer review to a later time. If the user immediately reviewed the project summary, he or she would accept the project summary data, defer its acceptance, or edit the data prior to accepting it. Upon acceptance, the 1391 Processor would update block 8 (Project Cost), as well the line items in block 9. If the summary was unread or deferred, DTMS would display the message every time a user with change authority accessed the corresponding 1391 form (or, possibly, merely signed on to the 1391 Processor), until the updated project summary was accepted or permanently rejected.

CEG/MEG/HAC

As indicated above, either CEG, MEG, or HAG can generate input to FEG, which in turn could be used to generate input to the 1391 Processor.

The CEG provides cost estimates at the concept design stage, before the detail required by FEG becomes available. Therefore, CEG operates by extrapolating a detailed input deck suitable for input to FEG from the aggregate knowledge available at concept design.

CEG includes three computer programs:

1. The Library Builder Program creates and maintains CEG libraries, which contain predefined relationships of Facilities to Systems, Systems to Subsystems, Subsystems to Assemblies, and Assemblies to UPB items. These CEG libraries must be carefully prepared.

2. The Library Writer Program prints a copy of a CEG Library. No special data preparation is required for the Library Writer.

3. The Deck Builder Program generates the card images for input into the FEG "Create Estimate" program. This program uses known information for a partially designed project (CEG data file) and the CEG Library data to generate the detailed data required for the FEG "Create Estimate" input file. (The *CEG User's Manual*[10] further details the components of CEG.)

MEG contains one data file for each mobilization standard facility design. Each data file is identified by a design number and contains a detailed quantity survey in FEG format. In case of mobilization, these standard files need only be revised to include options reflecting site adaptations.

In the MEG database, each facility's file is divided into several bid items using FEG Project and BI cards. The project level permits the introduction of costs which apply to the entire project: sales taxes on materials; general contractors' overheads and profits; contingencies; supervision, inspection, and overhead (SIOH); and other items necessary to complete a current working estimate (CWE). All building quantity surveys are contained in BI 002. BI 001 has been reserved for contractors' indirect cost and/or general

[10] *Control Estimate Generator (CEG) User's Manual* (CEHND, September 1984).

conditions. BI 003 should be used for site work/preparation. It may be desirable to further subdivide BI 002 for some of the MEG data files.

HAG will consist of a collection of FEG input files for previously awarded projects and an index to all such files. Thus a current working estimate for a new project, or a cost engineering evaluation for an ongoing project, can be made by retrieving detailed data for a previous, similar project, editing the data if necessary, and processing it through FEG with the current cost data bases. HAG might be used during any year of the Military Construction, Army (MCA) process (Guidance, Design, Budget, or Program Year). The index to previous projects stored in HAG will use data base manager software to assist estimators in identifying appropriate previous projects.

CACES/1391 Processor/CAPCES

CAPCES,[11] a component of the Programming, Administration, and Execution (PAX) system, supports MCA and other military construction programs. The main data file in CAPCES is the Project Monitoring Master File (PMMFILE) database. CADETS (Computer Applications Data Element Tracking Subsystem) is a data dictionary of the PMMFILE's contents. CAPCES also contains cross-reference tables and temporary files.

No data will flow directly from CACES to CAPCES, but rather whenever cost data is accepted from CACES into the 1391 Processor, appropriate project size and cost data updates should be routed from the 1391 Processor to CAPCES. The CAPCES user should not have the option of rejecting such updates. Table 1 lists the CAPCES data elements.

CAEADS/1391 Processor

CAEADS, being developed at USA-CERL, integrates various computer based design tools. With this system, architects and engineers doing concept designs for military facilities can investigate alternate designs faster, more easily, and more completely, often discovering cost and energy savings in the process.

Discussions with those responsible for the development of CAEADS indicated no significant applications for the direct automatic transfer of data in either direction between the 1391 Processor and CAEADS. The 1391 Processor is primarily used for programming and budgeting, and it is first used in the guidance year by installations requesting a project, while CAEADS is not used until the design year, when a complete complete design is analyzed. In the future CAEADS will be able to produce both concept and final designs, but in either case, the detail of information in the 1391 Processor is insufficient for use in CAEADS.

Although a direct link is not recommended, in the future CAEADS and the 1391 Processor could be related through CACES. The concept design process specifies the square footage (or other measure) more accurately than the budget estimate process does, and thus it produces information which is necessary for updating the cost estimate of the proposed facility. USA-CERL is developing a CAEADS module to generate a data

[11] *Construction Appropriations, Programming, Control, and Execution System (CAPCES) Training Manual* (maintained by the Programming and Execution Support Office, Directorate of Engineering and Construction, Headquarters, U.S. Army Corps of Engineers [HQUSACE]).

Table 1

Corresponding Data Items: CAPCES/1391 Processor

CAPCES Segment	CAPCES Field	DD Form 1391 Processor Block	Title
ZCPPFILE	UM	11A	U/M
	PROCPA	8	Project Cost ($000)
ZCP2FILE	CURR_1391_DT	2A	Date

file containing a systems description of building projects once the concept designs have been entered into CAEADS. This file will be processed by the CEG and FEG of CACES to produce concept design cost estimate reports. The Project Summary report could be transferred to the 1391 Processor. However, this would be a CACES/1391 rather than a CAEADS/1391 data transfer.

It might be possible to transfer several numbers reflecting the energy used for heating and air conditioning each year from CAEADS to the 1391 Processor. Most of the Corps Districts use CAEADS late in the design year for calculating the annual energy usage for new facilities. The actual calculations are performed by the Building Loads Analysis and System Thermodynamics (BLAST) energy analysis program, rather than by CAEADS. This information is normally incorporated into the the 1391 Processor in the textual information in Special Requirements Paragraph (SRP)-3, and in the preparation of the economic analysis for the project.

DD Form 1391 also requires a site sketch and a facilities requirements sketch. CAEADS would not be very useful in this respect. The site sketch, which locates new facilities on the installations, is often an annotated excerpt from one of the installation's general site plan sheets and therefore would not be generated by CAEADS. The facilities requirements sketch is a freehand sketch of the facility site, and although it could be generated by CAEADS, more likely it would be done on a microcomputer-based system such as AutoCAD or the freehand sketching program PC-Key-Draw.*

CAPCES/SAM

SAM[1,2] enables planners at Headquarters, Department of the Army (HQDA), Major Commands (MACOMs), and Corps of Engineers Divisions, Districts, and installations to compare facility assets with the projected unit force structure. Thus, they can analyze the effects on facility requirements of proposed stationing plans in either peacetime or mobilization scenarios. SAM is not yet completed, and the design is subject to change, so all statements concerning its data should be confirmed.

Some of the permanent SAM data items are extracted from permanent files within CAPCES and stored in extract files or cross-reference files. These extracted items must be modified to fit into the SAM data base. (SAM is still undergoing development and revision, so all statements here concerning its data structure require confirmation.)

*AutoCAD is published by Autodesk, Inc.; PC-Key-Draw is published by OEDWARE, Inc.

[1,2] C. C. Corbin, J. J. Fittipaldi, and R. D. Webster, *Stationing Analysis Model (SAM): System Overview, Functional Description* (Draft USA-CERL Report).

DSSCAT is the only temporary SAM data element derived from CAPCES. It is derived by rolling up all the facility category codes (CAPCES data element CATCD5). This element creates groups of generic military units, each representing a force structure at some unspecified location and time. This differs from other automated systems for analyzing construction which are concerned with the specifics of structures.

Only the following six data elements transfer without modification from CAPCES to SAM: KEYNR, CATCD5, CURR_SCOPE, UM, PROG_AMT, and PROJ_DESC. The other transferred information is modified for use in the SAM data base.

SAM addresses the overall, long term picture, rather than daily updating. Thus, although many changes are expected in the CAPCES data base each year, the SAM data base needs only periodic updates from CAPCES and other data bases. Requirements are presented to SAM in such areas as personnel, equipment, and demographics (the requirements are classified). SAM then searches for the required data in the Integrated Facilities Support (IFS) system and CAPCES. CAPCES provides SAM with necessary data about location, time, facility category codes, scope, and units.

At the time of this report, DTMS could be used to send a message informing the SAM user of a change to any CAPCES data element(s) which may affect some previously completed SAM analysis. Once the SAM data base is completed, this would no longer be necessary.

Table 2 relates CAPCES and SAM data elements.

ECONPACK/1391 Processor

ECONPACK[13] permits PAX users to perform economic analyses of military construction projects and to compare the economic benefits of alternative projects. Given the various recurring and nonrecurring costs associated with a project (e.g., construction, maintenance, energy, personnel), ECONPACK accumulates the undiscounted and discounted life cycle costs of the project.

Currently, all information to perform an economic analysis is entered in the ECONPACK system, which also generates reports. Files containing such reports can be inserted into the 1391 Processor, under SRP-1. A summary of the economic analysis reports is written into Detailed Justification Paragraph 11 of the 1391 Processor. No DTMS intervention is needed to transfer information from ECONPACK to the 1391 processor, since file transfer capabilities between the two already exist. Revisions in using ECONPACK are suggested.

Inputs to ECONPACK

ECONPACK input consists of (1) information to control the economic analysis and (2) information for each alternative project. (The information may be prepared either during an interactive terminal session, or with a text editor. The keywords used by ECONPACK to identify each input item are not indicated in the following paragraphs.)

[13] *Economic Analysis for Military Construction, Army* (CEHND, July 1986).

Table 2

Corresponding Data Items: SAM/CAPCES

File Name	Segment Name	SAM Field Name	CAPCES Field
Permanent SAM Elements Derived From CAPCES			
SAM			
FYDPPMM MASTER	FYDPPMM	KEYNR*	KEYNR
FYDPPMM MASTER	FYDPPMM	INST-X	INST
FYDPPMM MASTER	FYDPPMM	CATCD5*	CATCD5
FYDPPMM MASTER	FYDPPMM	STANAME X	INST,MILCMTY,STA_NAM
FYDPPMM MASTER	FYDPPMM	CURR SCOPE*	CURR SCOPE
FYDPPMM MASTER	FYDPPMM	UM*UM	
FYDPPMM MASTER	FYDPPMM	PROG AMT	PROG AMT
FYDPPMM MASTER	FYDPPMM	CFYI	CFY
FYDPPMM MASTER	FYDPPMM	PROJ DESC*	PROJ DESC
PMMDSS MASTER	PMMDSS	MCAPU1	CFY, UM, CURR SCOPE
PMMDSS MASTER	PMMDSS	MCAPU2	CFY, UM, CURR SCOPE
PMMDSS MASTER	PMMDSS	MCA1U1	CFY, UM, CURR SCOPE
PMMDSS MASTER	PMMDSS	MCA1U2	CFY, UM, CURR SCOPE
PMMDSS MASTER	PMMDSS	MCA2U1	CFY, UM, CURR SCOPE
PMMDSS MASTER	PMMDSS	MCA2U2	CFY, UM, CURR SCOPE
PMMDSS MASTER	PMMDSS	MCA3U1	CFY, UM, CURR SCOPE
PMMDSS MASTER	PMMDSS	MCA3U2	CFY, UM, CURR SCOPE
PMMDSS MASTER	PMMDSS	MCA4U1	CFY, UM, CURR SCOPE
PMMDSS MASTER	PMMDSS	MCA4U2	CFY, UM, CURR SCOPE
PMMDSS MASTER	PMMDSS	MCA5U1	CFY, UM, CURR SCOPE
PMMDSS MASTER	PMMDSS	MCA5U2	CFY, UM, CURR SCOPE
PMMDSS MASTER	PMMDSS	INSTP	INST
PMMDSS MASTER	PMMDSS	DSSCATI	CATCD5
Temporary CAPCES Elements Used by SAM			
CAPCES			**Format Usage**
PMMFILE MASTER	NONE	TEST	CATCD3,PDES I1
PMMFILE MASTER	NONE	CFYI	CFY I2
PMMFILE MASTER	NONE	INST X	INST A5
PMMFILE MASTER	NONE	STANAME X STA NAME	INST,MILCMTY A28
Temporary SAM Elements Derived From CAPCES			
SAM			
FYDPPMM MASTER	NONE	DSSCAT	CATCD5 A5

Control Information. The following items are used for control:

- Title - up to five strings, each up to 68 characters long. These could be drawn specifically from the 1391 Processor to include such items as project name, location, and project number.

- Organization - one string (up to 37 characters), intended to include the point of contact.

- Date - of submission and/or or analysis (up to 37 characters).

- Period of analysis - in years, maximum of 100.

- Start year - first year for which cost data is given. The construction start date from the 1391 Processor could be used for this.

- Base year (optional) - reference year for present worth calculations; must not be less than start year. If not given, assumed equal to start year.

- Discount rate - e.g., 10 for 10 percent.

- Inflation rates (optional) - each cost item, identified by a string of up to 30 characters, and an inflation rate for each year of the analysis. Economic analyses are generally done in constant dollars. Thus one of the cost items may be designated as "general inflation." The general inflation rates are "factored out" of the other inflation rates in order to achieve the differential cost fluctuations for each item. Alternatively, the inflation rates can be entered as differential cost changes, and no general inflation cost item need be specified.

- Residual value schedules (optional) - up to eight schedules indicating the fraction of original value an asset retains after each year of the analysis. Specific schedules are selected in the alternative section.

Alternative Specific Information. The following items are prepared for each alternative:

- Title - up to five lines, each with 72 characters. This information could be shared with the 1391 Processor.

- Name - up to 20 characters.

- Expense items - each expense item is identified by a string of up to 36 characters (e.g., construction, maintenance, repairs, utilities, services, administrative, allowances, demolition) and by the appropriate cost applicable to each year of the analysis. Each expense value may be discounted as if occurring at either the beginning, middle (the default), or end of the year in which it occurs. For each expense item, an inflation schedule from the controlling information may be selected.

- Salvage value (optional) - a starting value is given. A straight line, declining balance, or a user-specified (from the controlling information) schedule of depreciation is allowed. An inflation schedule and a discount period (beginning, middle, or end of year) may also be selected for the salvage costs.

- Expense item classification for standard reports - classifications are included with the description for each alternative.

ECONPACK Reports

For Army projects, two types of economic analyses are designated:

1. Primary analyses to evaluate a change from existing conditions. These require a report format known as Format A-1, in which all expense items are classified as either investment, recurring, or research and development.

2. Secondary analyses to compare two or more alternatives for satisfying an Army requirement. These require a report format known as Format A, in which all expense items are classified for the status quo as either recurring or refurbishment; and for the proposed alternative as either recurring, new asset, inherited asset, or replaced asset.

In addition to Format A and Format A-1, ECONPACK also can generate:

- A Format B report, containing various textual information describing the derivation of cost estimates and a discussion of nonquantifiable benefits
- A summary report showing the cumulative discounted values for each alternative after each year
- A report for each alternative displaying each year's expense items and the cumulative discounted values for all items
- Reports of sensitivity analyses.

The following three fields of the 1391 form could be completed from values which are or could be calculated in an ECONPACK run.

1. Supplemental Data A, Estimated Annual Cost to Operate Facility (block SA, saved in UDAT[1085-1096] of 1391 SAVE file). As stated AR 415-15, page 10-1, this item includes fuel and energy costs, other utility costs, personnel costs for facility operation (e.g., power plant operations), and all maintenance costs. If ECONPACK users were specifically required to identify these expense items (using predefined identifiers) then ECONPACK could be revised to calculate this value.

2. Supplemental Data C, Estimated Life-cycle Cost to Operate and Maintain Facility (block SC, saved in UDAT[1145-1156]). These costs include those from supplemental block A plus the costs of design still to be done, construction, operation, disposal or demolition (when applicable), and the additional needed to carry out the function of the new facility (e.g., additional cooks and dishwashers needed in a new dining hall). If these expense items are separately specified in ECONOPACK, then ECONPACK could be revised to calculate this value. Again, ECONPACK users would be required to assign predefined names to expense items.

3. Supplemental Data D, Estimated Life-cycle Cost to Operate and Maintain the Existing Facility if the New Facility is a Replacement (block SD, saved in UDAT[1157-1168]). The title for this item is deceptive, since Paragraph 10-2d of AR 415-15 indicates that this really is the cost of upgrading the existing facility to perform the required mission. This analysis, if applicable, is required by Congress. All the costs in (1) and (2) above must be included plus the costs of required upgrades or renovations to the existing facility (design and construction costs). Design and construction costs are also listed separately in this block. For ECONPACK to generate the three numbers for this block, the alternative corresponding to this block would have to be given a

predefined name, and the expense items associated with it would also have to be given predefined names. Table 3 summarizes the above.

ETIS/1391 Processor

ETIS[14] is used to prepare environmental impact assessments and statements (EIA/EISs), and to assist in the design, construction, and operation of facilities so that applicable environmental standards and regulations are satisfied. ETIS consists of an umbrella or "shell" program which provides access to a series of computer programs:

- Environment Impact Computer System (EICS)
- Economic Impact Forecast System (EIFS)
- Computer Aided Environmental Legislative Data System (CELDS) (unrelated to 1391 Processor).
- Over 20 smaller programs in various stages of development.

EICS and EIFS, further described below, have potential DTMS interfaces with the 1391 Processor. CELDS is a data base of abstracts of Federal and State environmental regulations and standards, intended for use by nonspecialists. Since it has no data elements related to the 1391 Processor, it will not be discussed any further. The Pollution Abatement Alternative Technology System (PAATS), representing several of the smaller programs, may be useful for preparing the 1391 form, but is not a candidate for a DTMS interface.

EICS/1391 Processor

EICS identifies potential impacts resulting from changes in Army activities and guides the investigation of such impacts in the EIA/EIS process. Using information supplied by the planner, EICS creates a "need to consider" matrix of potential environmental problems associated with the proposed activity. Also, EICS highlights activities that are considered controversial by the public.

The EICS user must answer a series of "filter" questions depending on the functional area, e.g., construction. Output is obtained at two levels: review and detailed. The review level gives an overview of the nature of potential impact, and is primarily used to assist reviewers of completed EIAs and EISs and to aid in selecting the best environmental alternative from several possible actions. The detailed level, used primarily to help prepare major EISs, contains more specific attributes of each technical specialty, e.g., health and safety.

Depending on the functional area and the technical specialty, two of the filter questions may request the location and total cost for a project. The total cost data might be the same data required in the block 8 in the 1391 Processor.

[14] *Introduction to ETIS and Its Subsystems* (ETIS Support Center, Urbana, IL).

Table 3

DD Form 1391 Paragraphs Derivable From ECONPACK

Title	1391 Processor Block	Position in SAVE file
Supplemental Data A Estimated Annual Cost to Operate Facility	SA	UDAT(1085-1096)
Supplemental Data C Estimated Life-cycle Cost to Operate and Maintain Facility	SC	UDAT(1145-1096)
Supplemental Data D Estimated Life-cycle Cost to Operate and Maintain Facility if t..e New Facility is a Replacement	SD	UDAT(1157-1168)

EICS could provide data to two blocks in the 1391 Processor:

1. Block D9, Summary of Environmental Consequences, located at section DT09 in the SAVE file. This block requires text entry to summarize the project's environmental impact. It also references SRP-4.

2. Block SR4, SRP-4, Environmental Documentation, located at section SR05 in SAVE file. Section 9-2(d) of AR 415-15 describes the documents required.

EICS cannot provide the exact text needed by blocks D9 and SR4, but rather tables or text the 1391 Processor user needs to prepare these two blocks. Therefore, DTMS will not transfer any data directly from EICS to blocks D9 and SR4 in the 1391 Processor. To prepare blocks D9 and SR4, a user could:

1. Retrieve cost and size information from the 1391 Processor

2. Run the system EICS using the 1391 Processor information and receive the output

3. Analyze, then reformat, the output with a text editor for blocks D9 and SR4

4. Transmit these paragraphs to the 1391 Processor via DTMS.

When a 1391 Processor user with change authorization accessed a 1391 block D9 or SRP-4, the user would be given the option to accept the new information.

If a later change to the cost or size information for the project affects the environmental study, the 1391 Processor could generate a warning message that the environmental study may require updating.

EIFS/1391 Processor

EIFS allows planners to assess the magnitude of impact on the local economy caused by a proposed change in an Army activity. The system has socioeconomic statistics for every county in the nation, which can be aggregated into multicounty or multistate regions. By providing information useful for projecting and evaluating the magnitude of socioeconomic changes, EIFS helps identify serious problems early in the decision-making process so that other alternatives can be considered. EIFS acts as both an information source and an analytical tool. The current data base is obtained from a variety of sources: Census of Population, Census of Housing, Census of Manufacturers, Bureau of Economic Analysis (BEA) estimates, County Business Patterns (CBP) reports, and private marketing data firms.

To use EIFS, the user first selects a study area, which consists of one or more counties--a group as large as 800 counties can be accommodated. Next, the user selects a profile of interest. The most common one for the 1391 Processor users is "The Forecast Models" (profile #2). This profile has five sets of models, each corresponding to one of five functional areas (FAs) of military actions:

1. Construction (C)
2. Operations and Maintenance (O&M)
3. Training (T)
4. Mission Change (MC)
5. Contractor/Industrial Type Activities (CITA).

Each FA creates different economic and social effects in the surrounding community. The construction functional area models, which estimate the economic and social consequences of a construction project, are most likely to be accessed by 1391 Processor users.

The construction models require answers to several system-supplied questions. These include questions about project name, dollar volume of construction project, percent of total cost for labor, percent of total cost for materials, number of military families moving onto base from the local region, and average income of affected military personnel.

The project name and the project total cost are located in the 1391 Processor blocks 4A and 8, respectively. Therefore, the economic analysis that uses EIFS can be done while preparing the 1391 form.

EIFS could provide data to two blocks in the 1391 Processor:

1. Block D11, Economic Justification, located in section DT11 of the SAVE file. This block, which requires text entry (paragraph or table form), either summarizes the economic analysis and references block SRP-1 or justifies why a formal economic analysis is not required.

2. SRP-1, Economic Analysis, located in section SR02 in SAVE file. This block also requires some type of text entry (paragraph or table form), and provides the economic analysis needed to support the planning and justification phases of a proposed MCA project.

EIFS cannot provide the exact text needed by blocks D11 and SR1 directly to the 1391 Processor, but rather could provide the user with the data he or she needs to

prepare these two blocks. Therefore, DTMS would not transfer any data directly from EIFS to blocks D11 and SR1 in the 1391 Processor. To prepare blocks D11 and SR1, a user could:

1. Retrieve information from the 1391 Processor
2. Run the EIFS system using that information and receive the output
3. Analyze the output, then reformat it with a text editor
4. Transmit these paragraphs to the 1391 Processor via DTMS.

When a user accessed a 1391 form through the 1391 Processor, the user would be given the option to accept the information if DTMS was holding messages for either blocks D11 or SR1.

If a later change to the cost or size information for the project affects the environmental study, the 1391 Processor could generate a warning message that the economic analysis may require updating.

PAATS/1391 Processor

PAATS consists of several programs, accessible through the ETIS system, which together can do the following things:

- Catalogue and retrieve the air quality control requirements for each airshed in the country
- Estimate emissions from planned coal-fired power plants, based on such variables as fuel and size
- Estimate emissions from modulation-controlled incinerators
- Predict downwind effects from air pollution sources, using several U.S. Environmental Protection Agency (USEPA) approved models
- Send computerized mail and access resources allowing personnel to exchange information about pollution control.

The first four items are interactive programs which produce output to a computer screen, rather than printed reports. This information could be used by the person composing paragraphs D9 and SR4 of the 1391 form. However, these 1391 Processor paragraphs contain text rather than digitized data, so no direct data transfer via DTMS would occur.

Other Potential Interfaces

It is recommended that new interfaces be developed between ETIS and SAM. A primary concern of SAM is personnel strength. At the same time, the ETIS subsystems EICS and EIFS require data about military personnel strengths, as well as producing output data about these strengths.

An interface between ETIS and CAPCES may also be useful, because CAPCES can provide ETIS subsystems EICS and EIFS with some project data. DTMS could provide this data automatically to ETIS from CAPCES with no need of the user's assistance.

FPS/1391 Processor/SAM

FPS is a series of programs that provides a military planner with the means to evaluate an Army unit's personnel and equipment allowances from its Table of Organization and Equipment, then use this information to calculate facility space requirements in accordance with specific MCA planning criteria.

In December 1985, two consulting firms, HDR Systems and Richardson and Kirmse, completed a joint study for HQUSACE entitled *Evaluation of Category Code Criteria, Algorithms and Data Elements for Army Force Modernization Facility Planning System, Stationing Analysis Model, DD 1391 Processor.*[15] This report completely analyzes the data exchanges among these three systems. These data exchanges could be effected via DTMS.

PDB/1391 Processor

Introduction

A PDB, developed by a using installation, serves to develop and record (in two phases) the data necessary to program, budget, and initiate design of proposed construction projects. (Technical Manual [TM] 5-800-3[16] describes the Army requirements for the PDB and shows the two PDB forms.)

The first phase results in the PDB-1, which includes:

- Functional Requirements Summary which identifies
  - Size of each primary and secondary facility in appropriate units
  - Significant equipment
  - Number of occupants
- Documentation Checklist, which identifies necessary approvals, coordination, and studies which must be considered and acted upon early in project planning
- Technical Data Checklist, which tabulates technical and site development items significant for sizing and estimating the cost of a project.

This information is used to prepare the one page 1391 form. The using service of a facility submits the Functional Requirements Summary to the Directorate of Facilities and Engineering (DFAE) in early January of the guidance year. The DFAE submits the

[15] Richardson and Kirmse, and HDR Systems, *Evaluation of Category Code Criteria, Algorithms and Data Elements for Army Force Modernization Facility Planning System, Stationing Analysis Model, DD 1391 Processor* (Washington, DC, 1985).

[16] Technical Manual (TM) 5-800-3, *Project Development Brochure* (HQDA, 15 July 1982); DA Form 5020-R, *Project Development Brochure, PDB-1* (HQDA, February 1982); DA Form 5021-R, *Project Development Brochure, PDB-2* (HQDA, February 1982).

PDB-1 (DA Form 5020-R) and the one page 1391 form to the MACOM at the beginning of the following month.

The PDB-2 (DA Form 5021-R) provides detailed information to the designer and includes:

- Detailed Functional Requirements, which describes in detail to the designer the activities and personnel which will occupy the facility on a space-by-space basis
- Documentation Checklist, as in the PDB-1
- Design Data Checklist, which tabulates supporting information which must be available to the design agency.

The using service submits the Detailed Functional Requirements to the installation DFAE in June of the guidance year. The DFAE submits the PDB-2 and the 1391 form with justifications paragraphs to the MACOM the following month.

Some suggestions are given below regarding information the 1391 Processor could share with a computerized PDB processor. To the extent possible, these documents should share the same data files. Currently, no mainframe computerized system exists to support preparation and review of PDBs. However, USA-CERL is developing a microcomputer-based program (using the the RBase data base management package from Microrim) to support the development of both summary and detailed functional requirements and the maintenance of checklists.

Data Fields Existing in the PDB Which Can Be Shared

Table 4 lists simple data items which are common to 1391 forms and to PDBs. The 1391 form location in both the FOCUS data base and the SAVE file are given. In the PDB, these items appear on DA Form 5020-R. All these items are in the table called POC in the PDB system being developed. When these items are generated for the PDB and 1391 form, the DFAE has control over both documents. Thus an option could be created in the future computerized PDB to generate a new 1391 form via DTMS whenever a PDB was created, Alternatively, DFAE personnel could enter the information separately in both the 1391 Processor and the automated PDB.

Table 4

1391 Processor Data Elements Transferable to PDB

			1391 Processor			
Item	**Block**	**FOCUS File**	**Segment**	**Field**	**Format**	**Save File**
Installation	3A	DIRECTOR	LV1	INSTALLATION	A28	UDAT(139-166)
Subpost						UDAT(167-194)
Location	3B	DIRECTOR	LV1	LOCATION	A16	UDAT(253-268)
Year (FY)	2B	DIRECTOR	LV2	YEAR	A4	UDAT(131-134)
Category Code	6	DIRECTOR	LV3	CATCODE	A7	UDAT(233-240)
Project	4A	DIRECTOR	LV4	PROJ TITLE	A32	UDAT(309-380)
Perm Proj No.	7B	DIRECTOR	LV4	PROJNO	A7	UDAT(293-300)
Temp Proj No.	7A	DIRECTOR	LV4	TEMPNO	A7	UDAT(301-308)

In addition to these simple items, it might be possible to transfer detailed data on facility size. In the PDB-1 the size (usually in square feet) is estimated for each type of space within a building (office, conference, living, circulation and mechanical, etc.), and sometimes for other facilities (e.g., airfields). In the PDB-2 the size of each individual space is detailed. In either case, this information can be used to derive the size of each primary facility for a construction project. (Secondary facilities include such items as utilities, fences, parking lots, and special equipment; these will typically be entered manually into the 1391 Processor.) This information could be used in block 9A of the 1391 form, which is stored as lines of text in the COSTN file of the 1391 SAVE file, each line having a description, a unit of measure, a quantity, a unit cost, and total cost. (The cost information is not a part of the PDB, and therefore could not be transferred from that system.) Note that the 1391 Processor also has the capability to estimate a facility's size based upon such parameters as the number of persons or residents to be served and the space to be allocated to each. Such a size estimate is similar to that made from information in the PDB-1, but not as accurate as estimates derived from information in the PDB-2.

In another possible transfer, the Objective paragraph from the PDB could be used as the requirement paragraph of the 1391 form (Field 11E stored in TX25 of the SAVE file).

Detailed Justification Paragraphs of the DD Form 1391

The 1391 form requires the preparation of 18 detailed justification paragraphs (AR 415-15, Chapter 8). Reminders for most of these are in the PDB checklists. The supporting documents or text to satisfy some of the PDB checklist items can be directly copied into or used as the basis for appropriate 1391 form detailed justification paragraphs. The computerized PDB under development contains two tables, called DOCLIST (for the design data checklist) and D/TLIST (for the documentation and technical data checklists). Each row of these tables represents a checklist item, and contains a field called FILE, which references a file containing comments or documentation for the checklist item. Thus users of the microcomputer-based PDB can compose text and supporting information on such files. A protocol could be established in DTMS to send such files to the appropriate detailed justification paragraphs in the project's 1391 form. Within the 1391 Processor, text received from the PDB could be reviewed for acceptance and, if accepted, undergo additional editing. Currently, only one organization at any one time has change authority for a specific 1391 form, and thus would review any proposed changes which arrive as DTMS messages. Alternatively, an organization could be allowed to retain change authorization for a specific set of fields even when a 1391 form is at another level of review. This might be especially useful when detailed justifications or special requirements paragraphs need updating. Thus, a PDB user without current review authority for a specific 1391 form should be able to download a detailed justification paragraph from the 1391 Processor for revision, then return it to the 1391 Processor via a DTMS message.

In the 1391 SAVE file, each detailed justification paragraph is stored in DTxx, where xx is the number of the detailed justification paragraph, with a leading zero if necessary. Table 5 lists the 1391 form detailed justification paragraphs which correspond to PDB checklist items.

Special Requirements Paragraphs (SRPs) of the 1391 form

Table 6 gives the correspondences between the SRPs of the 1391 form and the PDB checklist. A user should be able to access or revise any of these paragraphs using either the 1391 Processor or the PDB System.

Table 5

Corresponding Data Items:
DD Form 1391 Detailed Justification Paragraphs/PDB Checklist

1391 SAVE Location	1391 Paragraph	PDB Item	PDB Checklist
DTO1	1. General		
	a. Coordination of chapels with Chief of Chaplains	C-11	Documentation
	b. Fuel conversions and cost comparison analysis	D-1	Documentation*
	c. Relationship to other projects	A-11	Documentation
	d. Aviation facilities	C-7 C-8 C-9	Documentation**
	e. Evaluation of technical maintenance, laboratory and R&D facilities	C-10	Documentation
	f. Coallocation of ADP EDFCs and TCCs and required approvals	A-2	Documentation
	g. Laundry and dry cleaning project coordination	C-15	Documentation
	h. Approvals for site/safety*** plans for facilities dealing with explosives/ toxic chemicals	B-4 C-17	Documentation Documentation
DTO3	3. Analysis of deficiency	C-18	Documentation
DTO4	4. Consideration of alternatives	C-19	Documentation
DTO6	6. Related furnishings and equipment	A-5	Technical Data‡
DTO8	8. Survival measures	C-3	Technical Data/ Design Data
DT15	15. Energy requirements‡‡	C-2	Documentation

*That is, the table on p 8-2 of AR 415-15 and any supporting paragraphs.
**Paragraphs cite necessary correspondence and the tabulation of aircraft.
***Cites necessary approval documents, or includes the documents themselves.
‡Compare paragraph 8-7 of AR 415-15.
‡‡A summary of the Energy Requirements Appraisal (ERA) often refers to the ERA in SRP-3 of the 1391, or to the PDB.

Table 6

Corresponding Data Items: DD Form 1391
Special Requirements Paragraphs/PDB Checklists

1391 SAVE Location	1391 Form Paragraph	PDB Item	PDB Checklist
SR02	1. Economic Analysis*	A-5	Documentation
SR04	3. Estimated Energy Consumption**	D-1	Documentation
		D-2	Documentation
		D-9	Technical Data
SR05	4. Environmental Documentation***	E-1	Documentation
		E-2	
		E-5	

*Combination of text and tables; some of the tables are from ECONPACK, and can currently be transferred to 1391 forms. In practice, Detailed Justification Paragraph 13 appears here or in the corresponding PDB item.
**Complete energy requirements analysis.
***AR 415-15, Paragraph 9-2d lists the items that must appear in this paragraph.

SAM/1390 Module

The DD Form 1390 Module is one part of the 1391 Processor and is documented in the manual for that system. The 1390 Module allows users to electronically prepare, edit, and review DD Form 1390, *Military Construction Program.*[17] The preparation of the 1390 form involves the collection of information from the DD Form 1391 Processor, CAPCES, IFS, and SAM, all of which are components of the PAX system.

DTMS could effect data transfer of authorized personnel information from SAM to line 6b of the 1390 form. In the FOCUS file named DD1390 in the 1390 Module, these data elements are in segments L6 through T6 and TOT6B of segment LV4. SAM does not contain, and therefore cannot provide, the current year personnel strength for line 6a of the 1390 form.

In two cases, the sum of several SAM fields provides a value for a 1390 Module field:

1. Field O6 in the 1390 Module, "Students, Officer," is the sum of the three SAM data fields SPCSO, STDYOFF, and SWOC.

2. Field P6 in the 1390 Module, "Students, Enlisted," is the sum of the three SAM data fields SPCSE13, SPCSE49, and STDYENL.

[17]DD Form 1390, *FY( ), Military Construction Program* (HQDA, December 1976).

All six of the above fields from SAM are located in the segment SPECSEG of the FOCUS file GROUP in the SAM data base. For each of these entries, the message from DTMS would show the 1390 Module user the three SAM data field values and the total value, and give the 1390 Module user the chance to accept the total value into the 1390 Module.

Field Q6 in the 1390 Module, "Students, Civilian," comes directly from the SAM data field SCIV, located in the segment SPECSEG of the FOCUS file GROUP in the SAM data base.

Unlike the 1390 Module, SAM does not differentiate between Permanent and Supported personnel, which are combined under the several entries of the SAM data field UASTRN (in segment STRNSEG of file GROUP). The data in the field UASTRN is stored by attribute: civilian, enlisted, or officer. Thus, before getting any strength data from the field UASTRN, SAM users must choose the attribute from another SAM field, called UATNAME (Unit Attribute Name), located in the segment UATNAME of the file GROUP. The UASTRN entry in SAM for officers is the sum of 1390 Module fields L6 and R6. The UASTRN entry in SAM for civilians is the sum of 1390 Module fields N6 and T6. The UASTRN entry in SAM for enlisted personnel is the sum of 1390 Module fields M6 and S6. Thus the 1390 Module user receiving a DTMS message from SAM could only get these three summed totals, and would need to manually divide them into the respective 1390 Module fields. Table 7 shows the data elements involved in this interface.

Table 7

Potential Data Transfer: SAM/1390 Module

1390 Module		SAM	
Field Description	**Field Name**	**Field Description**	**Field Name**
Students, Officer	O6	PCS for Officers + Temp Duty Officers + Warr Off. Candidate	SPCSO + STDYOFF + SWOC
Students, Enlisted	P6	PCS for All E1 Thru E3 + PCS for All E4 Thru E9 + Temporary Duty Enlisted	SPCSE13 + SPCSE49 + STDYENL
Students, Civilian	Q6	Civilians Not Military	SCIV
Permanent/Officer + Supported/Officer	L6 + R6	Unit Authorized Strength	UASTRN (Q's + W's)
Permanent/Enlisted + Supported/Enlisted	M6 + S6	Unit Authorized Strength	UASTRN (E's)
Permanent/Civilian + Supported/Civilian	N6 + T6	Unit Authorized Strength	UASTRN (C's)

Comments:

1. All 1390 Module data items are from FOCUS file DD1390, segment LV4.
2. All SAM data items are from SAM FOCUS file GROUP; ones corresponding to 1390 Module fields O6, P6, an Q6 are from segment SPECSEG; others are from segment STRNSEG.
3. All data items are stored as five-character integers.

3 DATA SUPPORT FILES AND SELECTED COMPUTER SYSTEMS

AR 415-17

AR 415-17 dictates the procedures for preparing empirical cost estimates (based on historical or gross size data) for military construction projects. Such estimates (called budget estimates) are used in initial preparation of the 1391 form, and are eventually replaced with estimates developed at the 35 percent and 100 percent design levels. Any budget estimates (and changes) made using the 1391 Processor must be transferred to CAPCES. Conversely, a change in the scope of a project within CAPCES necessitates a recalculation of the budget estimate for the 1391 Processor.

AR 415-17/1391 Processor

The necessary tables and data base for developing the empirical cost estimates specified in AR 415-17 are already included in four files of the 1391 Processor: CATCOST, GCATCOST, INDEX, and LOCATION. (Refer to "DD Form 1391 Processor System Data File Documentation" for more information.) The cost and index fields in these files are updated periodically (at least annually) by the Engineering Support Branch of the Directorate of Engineering and Construction. This information is distributed to all affected offices by Engineering Improvement Recommendation System (EIRS) Bulletins. CEHND uses these bulletins to update the information in the four files. A message is issued to all 1391 Processor users that this data has been updated. If this cost data has been updated after the generation or revision of the empirical cost estimate for a specific 1391 form, the next user to access that 1391 form via the 1391 Processor is given the option to issue the /UPDATE command, which recalculates the empirical estimate using the new cost data base. Any delay in the update of a cost estimate is not crucial, since the empirical estimates are used for planning purposes only. Instructions for creating and revising empirical estimates are included in the *DD Form 1391 Processor System Users Manual.*

AR 415-17/CAPCES/1391 Processor

Since CAPCES also involves budget estimates which must comply with AR 415-17, inputs to or values calculated during budget estimates within the 1391 Processor could be electronically transferred to the following CAPCES fields: PROJECT COST (PROJ_COST), PROCESS COST (PROCPA), CURRENT WORKING ESTIMATE (CWE_AMT), PERCENT CONTINGENCY (PER_CONT), CONTINGENCY AMOUNT (CONT), PERCENT SUPERVISION AND ADMINISTRATION (PER_SA), and CURRENT SCOPE (CURR_SCOPE). Typically, the empirical estimate would be created by the preparer of the 1391 form and sent to CAPCES via a DTMS message.

However, two special cases of changes to the empirical cost estimate must be addressed in DTMS and in any redesign of the 1391 Processor:

1. If a CAPCES user has authorization to revise the CURRENT SCOPE, and if a budget estimate (i.e., one based upon 35 percent design) has not yet been generated, a new empirical cost estimate must be generated. Two strategies are possible for this:

   a. A message could be sent to the 1391 Processor via DTMS and the empirical cost estimate could be updated either by the user with current revision authorization for the affected 1391 form or by the user who originally created the empirical estimate (if a

special message could be sent to this user). This strategy would not require the AR 415-17 data base to be accessible from within CAPCES.

b. A new estimate could be generated within CAPCES and then sent to the 1391 Processor via a DTMS message. This would require the CAPCES user to review all the support facilities associated with the project--information which is not typically available in CAPCES. Thus, unless there are no changes to the support facilities, the previous strategy would have to be used.

2. Empirical estimates must be revised if a relevant cost data file is revised. Currently, a 1391 Processor user must initiate recalculation of the empirical cost estimate. The 1391 Processor could then send a DTMS message to CAPCES. Alternatively, the 1391 Processor could automatically update all empirical cost estimates and generate the necessary DTMS messages to CAPCES.

Army Location Codes

ARLOCs identify every installation and area of the United States which may have military significance. These codes are established in DA Pamphlets (DA PAM) 525-12[18] and 525-13,[19] and used in various Army systems, including the 1391 Processor, 1390 Module, and CAPCES. (ARLOCs are not a separate computer system.) Presently, each system uses its own codes (which correspond in general, but not completely, to official Army location codes), and maintains tables to translate its codes into those of other systems it interacts with. However, ARLOCs are revised frequently, and corresponding revisions must be done with great care in automated systems not originally designed to allow such changes, because key values have to be changed without introducing any conflicting values.

ARLOC/1391 Processor

The 1391 Processor identifies each using organization with alphanumeric characters of up to five digits. For domestic installations this is usually (but not always) the ARLOC described in DA PAM 525-12; for U.S. Army, Europe (USAEUR) installations five character codes are used; and for districts, divisions, MACOMS, and Program Managers, an abbreviation of the organization name is used. The FOCUS file PASS in the 1391 Processor saves the organization names and codes. Each form in the 1391 Processor has an associated segment (an "LV5" segment) in the FOCUS file DIRECTOR for each organization which can access the form. These segments identify each organization with the code from the PASS file, and track the organization's access rights throughout the MCA programming process. When ARLOCs are updated, the codes used in the 1391 Processor to identify an installation are not automatically updated. However, this can be done manually by the staff maintaining the individual 1391 forms.

ARLOC/CAPCES/1390 Processor

CAPCES uses the ARLOCs as one key to each project in the data base (field INST in segment MAIN of the PMMFILE), and as a key to INSTSEG (installation segments) in the INSTTBL cross-reference file.

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[18]DA Pamphlet (DA PAM) 525-12, *Army Location Codes: States Within the United States* (HQDA, January 1980).

[19]DA PAM 525-13, *Army Location Codes: Foreign Locations* (HQDA, January 1980).

The 1390 Module keys in on the installation code used in the PMMFILE of CAPCES and then does a lookup on a separately maintained table to find the corresponding installation code used in the 1391 Processor. If no entry for the installation can be found, a 1390 form can still be generated, although later updates to that particular form will require manual intervention.

A common file for ARLOCs should be established within DTMS. Any Army system, when redesigned, should conform to this file. To support message and update transfer among systems connected by DTMS, this file would initially include multiple codes for locations whose codes vary among systems.

DA Form 2369/1391 Processor

DA Form 2369-1-R (one sheet), *Tabulation of Existing and Required Facilities—Installation Strengths*,[20] reports current and projected personnel at an installation. DA Form 2369-2-R (multiple sheets), *Tabulation of Existing and Required Facilities—Facilities Requirements*,[21] tabulates, by facility category code, the number of facilities that are (1) allowed (total), (2) required to perform the installation's authorized permanent mission (total), (3) existing or under construction, (4) appropriated but not yet under construction, and (5) semipermanent and temporary. Section 3-2 and pages B-7 to B-16 of AR 210-20, *Master Planning for Army Installations*, provide instructions for completing these forms.

For each installation, the 1391 Processor already has a FOCUS file named IXXXXX (where XXXXX is the installation number) for tabulating facilities corresponding to the 2369-2-R form. For each data element in the 2369-2-R form that is used in 1391 forms, Table 8 gives the location on the 1391 form, the input block and SAVE file location within the 1391 Processor, the column of the data on the 2369-2-R form, and the FOCUS segment and field name within each installation's FOCUS IXXXXX file in the 1391 Processor.

The existing inventory information in the 2369 form often is inconsistent with the existing inventory reflected in the IFS because the two data bases are often maintained by different personnel. Thus consideration should be given to deriving the 2369 form existing inventory information from that in IFS. When a new facility enters service, both data bases should be updated.

DD Form 1657/1391 Processor

Installations now complete DD Form 1657, *Determination of Unaccompanied Personnel Housing (UPH) Requirements*,[22] annually or when documenting the need for new UPH facilities. No standardized computer-based system exists for maintaining or submitting this form, although some consideration has been given to automating 1657 form submissions eventually, with an upgraded Housing Operations Management System

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[20] DA Form 2369-1-R, *Tabulation of Existing and Required Facilities—Installation Strengths* (HQDA, July 1974).

[21] DA Form 2369-2-R, *Tabulation of Existing and Required Facilities—Facilities Requirements* (HQDA, July 1972).

[22] DD Form 1657, *Determination of Unaccompanied Personnel Housing (UPH) Requirements* (HQDA, December 1976).

Table 8

Corresponding Data Items: DD Form 1391/DA Form 2369

Element	Line in 1391 Form Quant Data	Block of 1391 Processor	Position in 1391 Processor SAVE File	Columns on DA 2369-R-2	Position in FOCUS IXXXXX File of 1391 Processor
Unit of Measure	UM	11A	UDAT(645-664)	b	Segment LV5, field UM
Total Requirement	A	11B	UDAT(677-700)	d	Segment LV5, field REQUIRED
Existing Substandard	B	11C	UDAT(709-732)	-[1]	--
Existing Adequate	C[2]	11D	UDAT(741-764)	e[3]	Segment LV5, field EXIST
Funded, Not in Inventory	D	11E	UDAT(773-796)	e,f[4]	Segment LV5, field APPROP
Adequate Assets	E	11F	UDAT(805-828)	e,f	--
Unfunded, Prior Authorization	F	11G	UDAT(837-860)	g[5]	Segment LV5, field BALANCE3
Included in FY Program	G	11H	UDAT(869-880)[6] UDAT(881-900)[7] UDAT(913-936)[8]	g[5]	--
Deficiency	H	11I	UDAT(945-968)[9] UDAT(977-1000)[10]	g[5]	

[1] DD Form 2369-2 does not include this item, however, it does include nonpermanent facilities, which are often substandard.
[2] For troop housing only, this includes substandard and upgradable facilities.
[3] Column e of DA Form 2369-2-R includes both existing facilities and those under construction.
[4] Column f of DA Form 2369-2-R includes only appropriated, but not under construction.
[5] Column g of DA Form 2360-2-R includes Unfunded, Prior Authorization in Balance to Accomplish Mission, and is thus equivalent to Block 11B minus Block 11F minus Block 11G of the 1391 Processor.
[6] Fiscal Year.
[7] Authorized component only.
[8] Funded component only.
[9] From 1391 Processor, Blocks 11B minus 11F minus 11G minus 11H (authorized).
From 1391 Processor, Blocks 11B minus 11F minus 11G minus 11H (funded).

(HOMES). A new version of the 1657 form has been approved, and was implemented in calender year 1986.

For UPH, several data elements of block 11, Quantitative Data, on DD Form 1391 are manually extracted from the 1657 form. They are summarized in Table 9.

Service and District/Division Codes

CAPCES, the 1391 Processor, and the 1390 Module use codes to identify the using service and/or the responsible district or division for MCA projects. AR 415-15 (Table 5-3, pp 5-7), lists the using services, their official abbreviations, and their two-digit codes which are used in generating the MACOM Five Year Plans and Long Range Construction Programs.

CAPCES uses these codes in several places. The COMTBL FOCUS file contains the master list of using services. The fields ORIG_USVC, OUSTITLE and OR_USVC_NAME contain the two-digit code, the abbreviation (up to 7 characters), and the full name of the using service. The value of the ORIG_USVC field in the CAPCES PMMFILE (the master file of projects) cross references the COM2TBL file through the ORIG_USVC field. The major commands (a subset of the possible using services) are maintained in the MACMTBL FOCUS file. The fields CMDC, CMDTITLE, and CMD_NAME contain the two-digit code, official abbreviation, and the full name of the MACOM. The value of the CMDC field in the CAPCES PMMFILE cross references the MACMTBL file through the MACMBTL's CMDC field.

The 1391 Module uses codes of up to eight characters (the official abbreviation) to identify the major commands in the following three of its FOCUS files: DDRETURN (in MACOM field), DIRECTOR (in MACOM field), and PASS (in IDENT field). The IDENT field of the PASS file is also used for installation codes (from DA PAM 525-12 and 525-13), and for division and district abbreviations.

The 1390 Module also uses eight-character codes (official abbreviations) for MACOMs.

DTMS should maintain a central file of the official abbreviations. Whenever any abbreviations are revised, appropriate messages could be sent to the affected systems. The affected systems could either maintain a cross reference file between original and updated codes, or change the codes in their own data base. Of course any system, when redesigned, should use the most current codes.

Table 9

Corresponding Data Items: DD Form 1391/DD Form 1657

Item on 1391 Form	Block on 1391 Processor	Quant Data Line of 1391 Form	Line on Old 1657 Form	Line on New 1657 Form
Total Requirement	11B	A	27	14
Existing Substandard	11C	B	10	10a(2)
Existing Adequate	11D	C	31+34+35	17
Funded, Not in Inventory	11E	D	32	15c
Adequate Assets	11F (11D+11E)	E	-	-
Unfunded, Prior Authorization	11G	F	-	-
Included in Fiscal Year Program	11H	G	38*	19*

*Army does not currently use this line.

4 CONCLUSIONS AND RECOMMENDATIONS

This report investigated many interfaces among Army computer systems and data bases which are used for construction management. Several of these interfaces appear to be good candidates for automated data transfer using DTMS. Many data items were found to be similar in two systems, and such similarities are recorded in several tables. Tables 10 and 11 summarize the findings for each interface and refer to other tables where the detailed correspondences can be found.

Table 10

Interfaces Between Systems

Systems	Potential Exchange?	Table	Comments/Recommendations
CACES/1391	Y	--	CACES subprograms FEG and CRAG produce cost estimates which could be sent to 1391. All cost estimates produced with FEG and CRAG should be routed as DTMS messages to 1391 Processor. CEMG could be used to send the reports to DTMS.
CACES/1391/CAPCES	Y	1	When cost data from CACES goes to 1391, DTMS should route project size and cost data updates to CAPCES.
CAEADS/1391	N	--	No interface because systems are used at different times in the construction process and because 1391 information is not detailed enough for CAEADS. CAEADS may in the future contribute to concept design cost estimates done in CACES, which could be then be used in 1391 forms, but there would be no direct link.
CAPCES/SAM	Y	2	CAPCES currently supplies SAM with some data; DTMS could be used to notify SAM users of changes in CAPCES elements which might affect previous SAM analyses.
ECONPACK/1391	Y	3	Data transfer already exists. However, some 1391 fields could be calculated from ECONPACK, if that program were modified slightly.
ETIS (CELDS)/ 1391	N	--	CELDS is not related to 1391, so there would be no transfer.
ETIS (EICS, EIFS, PAATS)/1391	N	--	No direct transfer, because they cannot provide digitized data or exact text; however, output can be used as a resource while preparing a 1391 form.

Table 10 (Cont'd)

Systems	Potential Exchange?	Table	Comments/Recommendations
ETIS/SAM	Y	--	Recommend that an interface be developed because both systems require and calculate information on personnel strengths.
FPS/1391/SAM	Y	--	DTMS could exchange data among these systems.
PDB/1391	Y	4,5,6	If the preparation and review of the PDB is automated, the PDB and 1391 should share the same data files, as far as possible. Numerous data items could be shared.
SAM/1390	Y	7	SAM could provide several items of personnel strength information.

Table 11

Interfaces Between Data Support Files and Computer Systems

Interface	Potential Exchange?	Table	Comments/Recommendations
AR 415-17	Y	--	a) 1391 Processor implements AR 415-17. b) Empirical cost estimate required by AR 415-17 and prepared by the 1391 user could be sent to CAPCES via DTMS.
ARLOCS	Y	--	To facilitate information transfer among systems, a common file should be established in DTMS; initially a cross reference should also be maintained for those codes which vary among systems.
DA Form 2369/ 1391 Processor	Y	8	1391 Processor already has items corresponding to DD Form 2369. Form 2369 items should be derived from IFS.
DD Form 1657/ 1391 Processor	Y	9	Several items on DD Form 1391 are currently extracted manually from DD Form 1657; however, no DTMS transfer is possible unless DD Form 1657 is automated, as has been proposed.
Service Codes	Y		A central file of official abbreviations should be maintained in DTMS; other systems must either change or cross-reference; new ones should use central file.

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ACRONYMS

AR	Army Regulation
ARLOC	Army Location Codes
BEA	Bureau of Economic Analysis
BLAST	Building Loads Analysis and System Thermodynamics
BI	bid item
C	Construction (functional area)
CACES	Computer Aided Cost Estimating System
CADETS	Computer Applications Data Element Tracking Subsystem
CAEADS	Computer Aided Engineering and Architectural Design System
CAPCES	Construction Appropriations Programming, Control, and Execution System
CBP	County Business Patterns
CEG	Control Estimate Generator
CEHND	U.S. Army Engineer Division, Huntsville
CELDS	Computer Aided Environmental Legislative Data System
CEMG	CACES Electronic Mail Generator
CITA	Contractor/Industrial Type Activities (functional area)
COCG	Contractor's Overhead Cost Generator
CORV	CACES Output Report Viewer
CRAG	Cost Reports Analysis Generator
CWE	current working estimate
DA	Department of the Army
DA PAM	DA Pamphlet
DD	Department of Defense
DFAE	Directorate of Facilities and Engineering
DTMS	Data Traffic Management System
ECONPAK	Economic Analysis Package
EIA/EIS	Environment Impact Assessment/Statement
EICS	Environmental Impact Computer System
EIFS	Economic Impact Forecast System
EIRS	Engineering Improvement Recommendation System
EP	Engineer Pamphlet
ERA	Energy Requirements Analysis
ETIS	Environmental Technical Information System

FA	Functional Area
FEG	Final Estimate Generator
FC	Facility Cards
FPS	Facility Planning System
FY	Fiscal Year
HAG	Historical Analysis Generator
HOMES	Housing Operations Management System
HQDA	Headquarters, Department of the Army
HQUSACE	Headquarters, U.S. Army Corps of Engineers
IFS	Integrated Facilities System
INFOG	Information Generator
MACOM	Major Command
MC	Mission Change (functional area)
MCA	Military Construction, Army
MDAWC	Mechanical Ductwork Area and Weight Calculator
MEG	Mobilization Estimate Generator
O&M	Operations and Maintenance (functional area)
OCE	Office of the Chief of Engineers
PAATS	Pollution Abatement Alternative Technology System
PAX	Programming, Administration, and Execution system
PDB	Project Development Brochure
PMMFILE	Project Monitoring Master File
R&D	Research and Development
SAM	Stationing Analysis Model
SIOH	supervision, inspection, and overhead
SRP	Special Requirements Paragraph
TEX DRIVER	Time Sharing Executive Driver
T	Training (functional area)
TM	Technical Manual
UCI	Uniform Construction Index
UPB	Unit Price Book
UPH	Unaccompanied Personnel Housing
USA-CERL	U.S. Army Construction Engineering Research Laboratory
USAREUR	U.S. Army, Europe
USEPA	U.S. Environmental Protection Agency

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